

# ORTHODONTIC - SURGICAL MANAGEMENT OF IMPACTED MAXILLARY CANINES USING TUNNEL TRACTION TECHNIQUE

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## Abstract

Maxillary canines are the most common teeth that can undergo impaction after the third molars. A combined orthodontic-surgical treatment is commonly used to guide the favorably located impacted canines into their normal positions. There are three basic surgical techniques for uncovering a labially impacted maxillary canine but the closed eruption technique is believed to be the best method of uncovering labially impacted teeth, especially if the tooth is located high above mucogingival junction in the alveolus.

This case report describes the successful management of bilateral maxillary canine impaction in growing class II patient using tunnel traction approach.

**Keywords:** Canine impaction, Class II malocclusion, Tunnel traction approach.

## Introduction

Tooth impaction refers to the infra-osseous position of tooth even after its anticipated eruption time.<sup>1,2</sup> Most frequently impacted teeth are third molars, followed by permanent maxillary canines with a high prevalence of 1-2% in general population.<sup>3,4</sup> Most likely cause of canine impaction is a lengthened period of development and a long, tortuous path of eruption.<sup>3-5</sup> Of the total incidence of impacted maxillary canines, eighty-five per cent are palatal impactions and 15% are labial impactions.<sup>3,4,6</sup> However, Asian populations report more buccal impactions with female to male ratio in a range of 2.3:1 to 3:1.<sup>7-9</sup> Buccal canine impactions are often associated with inadequate arch space and vertical developmental position.<sup>4</sup> Such impactions diagnosed at a young age of 8 or 9 are often guided for spontaneous canine eruption by either deciduous canine extraction or space regaining by orthodontic mechanics.<sup>10,11</sup> In other situations, if clinical and radiographic examination indicate canine impaction, appropriate timing and surgical uncovering of canine is planned to bring the canine into occlusion.<sup>12,13</sup> For surgical uncovering of labially impacted maxillary canine, Kokich<sup>14</sup> has mentioned 3 techniques including excisional uncovering, apically positioned flap,<sup>15</sup> and closed eruption techniques.<sup>16</sup>

The selection of technique most appropriate for surgical uncovering is determined by four basic criteria<sup>14</sup>: the labiolingual and mesiodistal position of the impacted canine crown, the vertical position of the tooth relative to the mucogingival junction and the amount of gingiva in the area of the impacted canine.

Based on the above mentioned criteria, present case report illustrates closed eruption technique along with tunnel approach for the management of labially impacted bilateral maxillary canines in a growing class II malocclusion patient.

## Case report

An 11 year old male patient in CVMI stage II, reported to the outpatient department of Orthodontics and Dentofacial Orthopedics, with the chief complaint of forwardly placed upper front teeth.

Extraoral examination revealed a mesoprosopic face, convex profile, and incompetent lips with lower lip trap (Figure 1 a-c).



Figure 1: Pre-treatment extraoral photographs (a-c), Pre-treatment intraoral photographs (d-h), Pre-treatment lateral cephalogram (i), Pre-treatment orthopantomogram (j).

Intraoral examination revealed an Angles Class II division 1 malocclusion with increased overjet (9 mm) and overbite (82%). There were presence of retained deciduous maxillary canines bilaterally and missing permanent maxillary canines. Crossbite was present in relation to maxillary left permanent first molar with a lower midline shift towards right by 1 mm. [Figure 1 d-f]

On palpation, a buccal bulge was felt apical to the retained deciduous maxillary canines bilaterally.

The pre-treatment orthopantomogram revealed bilaterally impacted maxillary permanent canines. The canines according to classification by Lindauer SJ *et al*<sup>17</sup> were in sector II. [Figure 1 j]

The cephalometric analysis indicated skeletal class II malocclusion with deficient mandible and average mandibular plane angle. The patient was in CVMI- II (acceleration stage) of pubertal growth with 85% of growth remaining.<sup>18</sup> [Figure1- i and Table 1]

	T 1	T2 ( After twin block Treatment)	T3
<b>Linear (mm)</b>			
1. Maxillary base	46	47	47
Maxillary base Art-A	76	77	78
Mandibular base Art-Pog	87	91	92
4. Mandibular base Art-B	80	84	84
Total anterior facial height N-ANS + ANS-ME	91	95	96
Lower anterior facial height ANS-Me	47	51	52
Lower anterior facial height /Total anterior facial height (%)	51.6 %	53.7%	54%
Overjet	8	3	2
Overbite	5	2	2
Angular (°)			
SNA	82	82	82
SNB	76	79	80
ANB	6	3	2
SN/Man	32	33	33
Max/Man			
Upper incisors to SN	124	114	115
IMPA	90	92	98
Upper incisors to NA mm	8	3	2
Lower incisors to NB	4	4	5
FMA	26	27	28

Table 1: Cephalometric measurement at the beginning of treatment T1, after twin block treatment T2 and at the end of fixed orthodontic treatment T3.

**Treatment objectives**

Keeping in view the growth status of the patient, the primary treatment objective was correction of mandibular retrognathism and establishment of skeletal class I relationship. This was to be followed by de-impaction of permanent maxillary canines and achieving canine guided functional occlusion by bringing both the maxillary permanent canines into appropriate alignment and occlusion. Other objectives to be achieved were correction of overjet and overbite, lower lip trap and cross bite in relation to left maxillary first molar. Final objective was to establish class I molar and canine relationship with skeletal Class I relation.

**Treatment plan and progress**

To utilize the growth potential of the patient (CVMI-II), a two-phase treatment was planned that included a functional phase followed by fixed mechanotherapy. The deciduous maxillary canines were retained till the functional phase was completed.

Functional phase (duration 9 months): Twin block appliance was used to correct the skeletal discrepancy for a duration of 9 months. At the completion of this phase (9 months), bilateral class I molar relationship with correction of overjet and overbite was accomplished. [Figure 2]

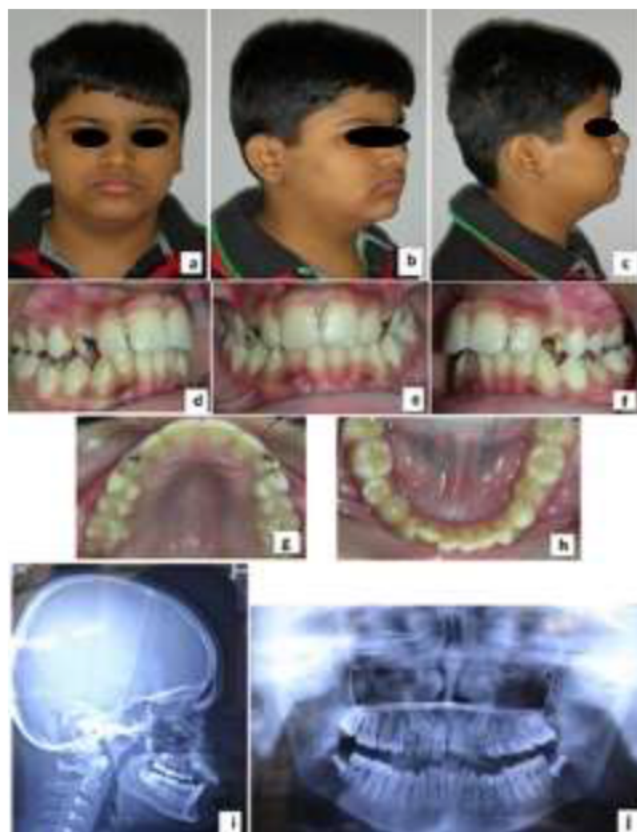


Figure 2: Mid - treatment extraoral photographs (a- c), Mid -treatment intraoral photographs (d-h), Mid -treatment lateral cephalogram (i), Mid-treatment orthopantomogram (j).

Fixed mechanotherapy (duration 12 months): Preadjusted edgewise appliance (MBT 0.022 prescription Elite OPTI-MIM MBT Ortho Organizers, Carlsbad, CA, USA)\* was used for fixed mechanotherapy. The initial levelling and alignment was achieved with 0.016” Niti archwire. After initial alignment and levelling of arches till 0.017 x 0.025 stainless steel arch wire, round loops were formed in the arch wire facing occlusally between the lateral incisors and first premolars to engage the elastic chain from impacted canines.

Surgical exposure of buccally impacted maxillary canines: Technique performed for surgical exposure involved raising full thickness (muco-periosteal) flaps bilaterally with vertical releasing incisions high enough to elevate the flaps in order to expose the unerupted canines. Windows were cut on the cortical bone to expose 1/2 to 2/3 of crowns of the canines followed by removal of follicular sockets. Care was taken not to expose the cement-enamel junction of the canines. Orthodontic brackets 0.022”x0.028” slot of MBT prescription (Elite OPTI-MIM MBT Ortho Organizers, Carlsbad, CA, USA ) were then

bonded on to the labial surfaces of the exposed canines and the maxillary deciduous canines were then extracted. Short elastomeric chains (Short clear chain elastic 3M Unitek, Monrovia, CA ) were placed on to the brackets, drawn inferiorly through the tunnel created as a result of extraction of deciduous canines, and hooked on to the stainless steel archwire with loops in occlusal direction. [Figure 3]

Flaps were sutured back to their original position and patient was discharged after giving necessary instructions. Sutures were removed after one week and the gingival condition was assessed.



Figure 3: Surgically exposed maxillary right canine with attachment and traction (a), exposed maxillary left canine with attachment and traction (b)

Both maxillary canines were positioned into proper alignment with the remaining teeth within 3 months of exposure. Following this, final finishing was completed with the 0.019x0.025 stainless steel archwires and the case was debonded after 12 months of active orthodontic treatment. Post treatment intraoral and extraoral records were taken. [Figure 4]



Figure 4: Post-treatment extraoral photographs (a-c), Post-treatment intraoral photographs (d-h), Post-treatment lateral cephalogram (i), Post-treatment orthopantomogram (j).

Retention: Hawley’s retainer was given in maxillary arch for retention while in the mandibular arch, fixed canine to canine retainer was bonded.

**Results**

Significant improvement in the facial aesthetics (profile) was observed with decrease in the facial convexity, correction of deep mentolabial sulcus and lower liptrap. Bilaterally impacted maxillary canines were aligned without adversely affecting the periodontium and adjacent teeth. Bilateral class I molar and canine relationships were attained along with optimum overjet and overbite and appropriate canine guided occlusion. Treatment results and periodontal status of the maxillary canines were satisfactory at the end of treatment and even after one year of treatment.

Cephalometric analysis: Showed decrease in ANB angle by 4 degrees with increase in lower incisor to mandibular plane angle by 8 degrees. However, the mandibular plane angle increased by 2 degree. [Table 1]

**Discussion**

Treatment timing has a significant role in the management of growing patients in orthodontics. Correction of canine impaction in growing class II malocclusion cases is challenging for an orthodontist as correction of skeletal discrepancy is also required along with the management of impactions.

Closed eruption mechanics was chosen for eruption of labially impacted canines to closely mimic the normal eruptive process in order to allow the teeth to erupt in the centre of the alveolus.<sup>16</sup> Surgical exposure involved elevation of flap followed by placement of an attachment on the impacted tooth, and re-suturing the flap to its original location.<sup>16</sup> Our main emphasis was to preserve the extraction socket of the deciduous canines as tunnels to guide the eruption of permanent maxillary canines into their normal positions, so as to offer minimal resistance to the erupting canines, thus reducing the treatment time. The functional and esthetic concerns of the patients with regards to the impacted teeth have been duly addressed in the present case. Our findings are in accordance with, Vermette *et al* who highlighted the differences between closed eruption and apically positioned flap techniques. Although no significant differences in gingival index, plaque index, pocket depth, and bone level, but significant aesthetic differences were identified.<sup>19</sup> Increased clinical crown length was associated to apically positioned flap along with increased width of attached tissue, gingival scarring, and intrusive relapse. However, these negative esthetic effects were not present in closed eruption technique as witnessed in several studies.<sup>19,20</sup> Becker *et al* found similar aesthetic results in their study of closed eruption technique for uncovering impacted maxillary central incisors.<sup>20</sup> Hence, the chosen technique of closed eruption for surgical uncovering of impacted canines in the present study revealed healthy periodontal status and acceptable aesthetic results post-treatment as well as after

one year follow-up. Besides, the functional appliance therapy also led to correction of skeletal class II discrepancy with forward positioning of the mandible and correction of facial profile.

### Conclusion

Appropriate treatment timing for correction of skeletal discrepancy combined with adequate technique for surgical exposure of impacted canine was the main factors determining achievement of treatment objectives and success of treatment. The treatment results in this case were quite acceptable as both skeletal correction of class II malocclusion as well as alignment of impacted canines with good esthetics were achieved in fairly 21 months of active treatment.

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